Arsenic Master Plan Summary Report

On January 23, 2001, the Environmental Protection Agency (EPA) reduced the drinking water maximum contaminant level (MCL) for arsenic from 50 parts per billion (ppb) to 10 ppb. While the process under which the MCL revision was made was confusing and filled with delays and changes, the date that is important for water systems is **January 23, 2001**.

The federal arsenic rule requires all community water systems (CWS) and non-transient non-community water systems (NTNCS) to comply with the new 10 ppb MCL within five years of promulgation of the federal rule. In other words, water systems must comply with the new arsenic MCL of 10 ppb by **January 23, 2006**. Compliance means all points of entry (POE) for water systems cannot be serving water with arsenic concentrations above 10 ppb by the January 23, 2006 deadline.

The Arizona Department of Environmental Quality (ADEQ) formed a stakeholder group to develop the Arizona Arsenic Master Plan (AMP) in response to the enormous impact this rule will have for Arizona water systems and their customers. In the following pages you will find the result of extensive stakeholder input and expertise from the Narasimhan Consulting Services (NCS).

Through a collaborative effort we have developed this targeted compliance strategy for Arizona water systems. The focus of this document is to:

- Make the complicated federal rule easier to understand
- To ensure all water systems affected by this rule are aware of what they are required to do and when it is required
- To look at each individual water system to determine, based on site specific conditions, which compliance options are preferred considering effectiveness and cost
- To identify all available financial assistance options and how to navigate the financial assistance process easily
- To provide assistance to water systems in choosing technical assistance providers should they be needed
- To provide a comprehensive listing of technical assistance providers who can assist with a system's individual arsenic compliance plan

Many hours of work by ADEQ, stakeholders and NCS have gone into completing this report. We believe this report will prove to be a useful tool for all affected water systems in devising the most appropriate and affordable path to compliance. By using this document small water systems will increase their ability to respond to this rule change within the federal compliance deadline of January 23, 2006.

ADEQ would like to thank all the people and organizations who dedicated their time, expertise, and knowledge providing invaluable assistance in putting together this first of its kind targeted

compliance strategy. There are too many of you to mention individually but you are all extraordinary people. A special thank you goes to Greg Swartz, Moncef Tihami and Ramesh Narasimhan without whose assistance the project would not have been possible.

Compliance Requirements

Overview

Often times when new state and federal drinking water rules are established they can be quite confusing to understand. Reading these complex and cumbersome rules can make it extremely difficult for water systems to determine what they have to do and when they have to do it.

In this section of the AMP, we have reviewed the federal rule and pulled out the requirements and placed them under simple headings. Each heading represents either a description of why the rule applies to your system or a description and summary of what the rule requires your system to do. The purpose of the Rule Summary Section is to allow you to easily answer questions such as:

1. Does the rule apply to my system?
2. Where do I have to monitor?
3. How often do I have to test my water?
4. Does my system qualify for "grandfathered" status, and how does that change what I have to do?
5. What am I supposed to do if arsenic is detected in my test results?
6. How do I know if I violated the MCL?
7. When do I have to make a public notification and what am I supposed to include in it?
8. What am I supposed to include in my annual Consumer Confidence Report?
9. Can I composite samples?
10. Are there any monitoring waivers available for arsenic and how do I get one?
11. What is an exemption and do I qualify for one?

Under each heading you will be able to easily determine the answers to these questions from the short explanation of the requirement. In addition to this summary we have created a matrix that describes the requirements for your water system on one page. By referencing the matrix for the population your water system serves, you should be able to determine the requirements for your water system, and when the matrix is used with the rule summary, you should be able to see a little more detailed explanation of the requirement should you wish to gain a better understanding of why you are doing certain things.

Rule Summary

Applicability

The arsenic regulation applies to all community and non-transient non-community water systems.

> **Community Water System:** A public water system that serves 15 or more service connections used by year round residents or that serves 25 or more year round residents.

> **Non-Transient Non-Community System:** A public water system that serves 15 or more service connections that are used by the same persons for at least 6 months per year; or serves the same 25 or more persons for at least 6 months per year.

Monitoring Locations

Community (CO) and Non-Transient Non-Community (NN) water systems are required to collect compliance samples from points of entry into the distribution system (POE).

> **Point of Entry:** The point at which water is discharged into the distribution system from a well, storage tank, pressure tank or water treatment plant.

CO and NN water systems should have already identified their POEs through the monitoring requirements for synthetic organic and volatile organic chemicals. If you are unsure where your POEs are located you will need to contact ADEQ for assistance.

Table A1 in Appendix A1 summarizes the requirements of the new arsenic rule and related requirements and timeframes.

Initial Monitoring Frequencies

If you are an existing system you are required to continue monitoring for arsenic as you have been since 1993.

> **Existing Groundwater POEs:** You must collect one sample from each groundwater POE once every 3 years during your ADEQ assigned monitoring year

> **Existing Surface Water POEs:** You must collect one sample from each surface water POE every year.

If you are a new system beginning operation after the date of this document or you have a new POE beginning operation after the date of this document, you are required to perform initial monitoring for arsenic during an ADEQ assigned monitoring year. ADEQ will assign your monitoring year during the water system source approval process. The initial monitoring frequency for arsenic varies depending on whether your source of drinking water is surface water

or groundwater and whether you have prior arsenic data that meets the grandfathering requirements.

> **Groundwater POEs Without Grandfathered Data:** You must collect one sample for arsenic at each POE between January 23, 2006 and December 31, 2007.
>
> **Surface Water POEs Without Grandfathered Data:** You must collect one sample for arsenic at each POE between January 23, 2006 and December 31, 2006.

Grandfathered Data
Systems can use arsenic data collected prior to the monitoring frequencies listed above to meet the initial monitoring requirements. In order to qualify for grandfathered status, systems must have collected arsenic data within the following time frames.

> **Groundwater POEs:** Samples collected and analyzed prior to January 23, 2006 may be grandfathered provided they were analyzed with a newly approved arsenic analytical methods (EPA 200.7, EPA 200.8, EPA 200.9, ASTM D-2972-93C, ASTM D-2972-93B, SM 3120B, SM 3113B, and SM 3114B) and the result is below the new MCL.
>
> **Surface Water POEs**: Samples collected and analyzed prior to January 23, 2006 may be grandfathered provided they were analyzed with a newly approved arsenic analytical method (see above) and the result is below the new MCL.

Routine Monitoring Frequencies
After meeting the initial monitoring requirements by either performing initial monitoring or using grandfathered monitoring data, water systems will be required to conduct routine monitoring at each POE. The routine monitoring frequency for arsenic varies depending on whether your source of drinking water is surface water or groundwater.

> **Groundwater POEs:** Must collect one sample at each POE once every three years. This monitoring is conducted in three-year increments beginning from the system's initial monitoring year, which is established by ADEQ.
>
> **Surface Water POEs:** Must collect one sample at each POE every year.

Increased Triggered Monitoring
If a system detects arsenic is detected in any sample from a POE above 0.010 milligrams per liter (mg/L), that system must increase the sampling frequency at that POE to quarterly. The system must continue quarterly monitoring at the POE with the arsenic sample result above 0.010 mg/L for at least four quarters. After completing four quarters of acceptable monitoring results at the POE that had the arsenic result above 0.010 mg/L the system may be determined to be "reliably and consistently" below 0.010 mg/L by ADEQ. In this case the system may be permitted to return to the routine monitoring frequency.

Groundwater POES after Four Quarters of Acceptable Increased Monitoring Results: You may return to sampling the POE once every three years with ADEQ approval.

Surface Water POES after Four Quarters of Acceptable Increased Monitoring Results: You may return to sampling the POE once every year with ADEQ approval.

Maximum Contaminant Level (MCL) Violation

A system will not be considered in violation of the MCL until they have completed one year of quarterly sampling. However, the system will be immediately out of compliance if any quarterly sample result would cause the running annual average to exceed 0.010 mg/L at any sampling point.

Example 1: If the results of quarter 1, 2, and 3 are 0.012 mg/L, 0.012 mg/L and 0.020 mg/L respectively, the system will be automatically out of compliance because the sum of the results exceed 0.40 mg/L -- (0.012+0.012+0.020 = 0.044); or (0.012=0.012=0.020)/4 = 0.11 mg/L. The average is greater than the MCL.

Example 2: If the results of quarter 1, 2, 3 and 4 are 0.012 mg/L, 0.014 mg/L, 0.004 mg/L and 0.006 mg/L respectively, the system will NOT be out of compliance because the average of the results does not exceed the MCL -- (0.012+0.014+0.004+0.006 = 0.036); or (0.012+0.014+0.004+0.006)/4 = 0.009 mg/L. The average is less than the MCL.

Public Notification (PN) and Consumer Confidence Report (CCR) Requirements

There are a number of different PN and CCR requirements associated with the arsenic rule. This section will explain which requirements apply to water systems and when they apply.

CCR Requirements for Results Above 0.0050 mg/L: If a water system detects arsenic in any sample above 0.005 mg/L but below 0.010 mg/L at any POE in any year prior to July 1, 2002, or in any calender year thereafter, the water system will be required to include the following language in their next year's CCR.

> "*While your drinking water meets EPA's standard for arsenic, it does contain low levels of arsenic. EPA's standard balances the current understanding of arsenic's possible health effects against the costs of removing arsenic from drinking water. EPA continues to research the health effects of low levels of arsenic which is a* mineral *known to cause cancer in humans at high concentrations and is linked to other health effects such as skin damage and circulatory problems.*"

CCR Requirements for Results Above 0.010 mg/L: If a water system detects arsenic in any sample above 0.010 mg/L at any POE in any year after July 1, 2002, or in any year thereafter, the water system will be required to include the following language in their next year's CCR.

"Some people who drink water containing arsenic in excess of the MCL over many years could experience skin damage or problems with their circulatory system, and may have an increased risk of getting cancer."

CCR Requirements for Results Above 0.0250 mg/L: If a water system detects arsenic in any sample above 0.0250 mg/L but below 0.050 mg/L at any POE in any year before July 2002, or in any calender year up to January 23, 2006, the water system will be required to include the following language in their next year's CCR.

"EPA is reviewing the drinking water standard for arsenic because of special concerns that it may not be stringent enough. Arsenic is a naturally occurring mineral known to cause cancer in humans at high concentrations."

CCR Requirements for Results Above 0.050 mg/L: If a water system detects arsenic in any sample above 0.050 mg/L at any POE before July 2002, or in any calender year up to January 23, 2006, the water system will be required to include the following language in their next year's CCR.

"Some people who drink water containing arsenic in excess of the MCL over many years could experience skin damage or problems with their circulatory system, and may have an increased risk of getting cancer."

PN Requirements for Systems With Monitoring and Reporting Violations
Systems that fail to collect samples from each POE at the frequencies listed in the monitoring section of this document are required to issue a Nonacute Level 2 PN to their customers. This PN must be issued no later than one year after the water system learns of the monitoring and reporting violation.

Distribution of the PN: The water system must deliver the PN to each customer of the water system by mail or other direct delivery. If a customer would not normally be reached by mail or direct delivery the system, with approval by ADEQ, may be permitted to provide the notice by publication in a local newspaper, posting in public places, posting on the Internet, or delivery to community organizations.

Mandatory PN Language for Monitoring and Reporting Violations: *"We are required to monitor your drinking water for specific contaminants on a regular basis. Results of regular monitoring are an indicator of whether or not your drinking water meets health standards. During [insert compliance period] we did not monitor or test for arsenic, and therefore cannot be sure of the quality of your drinking water during that time. Please share this information with all the other people who drink this water, especially those who may not have received this notice directly (for example, people in apartments, nursing homes, schools, and businesses). You can do this by posting this notice in a public place or distributing copies by hand or mail."*

PN Requirements for Systems With MCL Violations
If a system has an MCL violation at any POE the system is required to issue a Nonacute Level 1 PN to their customers. This PN must be issued as soon as possible, but no later than 30 days after learning of the violation. The system must repeat the PN requirement for an MCL violation every three months for as long as the violation exists.

> **Mandatory PN Language for MCL Violations:** *"Some people who drink water containing arsenic in excess of the MCL over many years could experience skin damage or problems with their circulatory system, and may have an increased risk of getting cancer."*

Compositing
Water systems are permitted to composite samples. Compositing is combining samples before they are analyzed. This allows the laboratory to run one analysis as opposed to several analyses. Water systems can only composite up to five samples. The compositing must be performed by the laboratory. Water systems must collect samples from each POE they wish to have composited and deliver them to the laboratory, and the laboratory will then combine the samples into one sample and perform the analysis. It is possible for the water from one POE in a composite sample to cause the overall result to be above the MCL.

If a composited sample results in an MCL exceedence, all of the POEs that were a part of the composite sample must be re-sampled and analyzed individually. Water systems should consider the historic arsenic levels of their POEs when deciding whether to composite so they can avoid the additional analytical cost if the composite sample result is above the MCL. The rules for compositing differ based on the population the water system serves.

> **Compositing for Systems Serving 3,300 or Fewer Persons:** A water system serving 3,300 or fewer persons may composite up to five samples with samples taken from other water systems serving 3,300 or fewer persons.

> **Compositing for Systems Serving More Than 3,300 people:** Water system may composite up to five samples from POEs within the same water system.

Reduced Monitoring
ADEQ may reduce the arsenic monitoring frequency for POEs to once every nine years. The decision to allow the monitoring frequency reduction is based on previous sample results. Water systems are required to have three rounds of samples, or test results from routine monitoring, which are all below 0.010 mg/L in order to qualify for a monitoring frequency reduction. The system is required to request this monitoring frequency reduction from ADEQ.

> **Groundwater POE Monitoring Frequency Reductions:** Systems with groundwater POEs can be approved by ADEQ to reduce their monitoring frequency from once every three years to once every nine years.

Surface Water POE Monitoring Frequency Reductions: Systems with surface water POEs can be approved by ADEQ to reduce their monitoring frequency from once every year to once every nine years.

Date You Must Meet the New Arsenic MCL of 0.010 mg/L
All Community and Non Transient Non Community water systems must ensure their drinking water does not have arsenic above 0.010 mg/L by **January 23, 2006**.

Arsenic MCL Until January 23, 2006
The arsenic MCL of 0.050 mg/L will remain in effect until January 23, 2006. Systems will be required to continue monitoring for arsenic under their current monitoring frequency.

Exemptions From the January 23, 2006 Compliance Date
Systems can apply to ADEQ for a time extension to come into compliance with the arsenic MCL of 0.010 mg/L if they are unable to meet the January 23, 2006 compliance date. These time extensions are called "Exemptions" under state drinking water regulations. In order to qualify for an exemption, a water system must demonstrate that several conditions exist that prevent them from meeting the January 23, 2006 compliance date:

1. The water system is unable to comply with the arsenic MCL because of compelling factors, which may include economic factors.
2. The exemption from the MCL will not result in an unreasonable risk to public health.
3. The water system does not have a reasonably available alternative source of water that can be used to achieve compliance with the arsenic MCL.
4. The water system is unable to make management or restructuring changes that will result in compliance with the MCL or improve the quality of their drinking water.
5. Necessary capital improvements cannot be completed before January 23, 2006.
6. The water system needs financial assistance for necessary capital improvements and has entered into an agreement to obtain the financial assistance or the water system has entered into an enforceable agreement to become part of a regional public water system.

An ADEQ approved exemption must contain a compliance schedule that includes interim control measures that the department deems necessary, and the dates for their implementation. The schedule will require compliance within two years of the date that the Exemption is issued. ADEQ can grant up to two 3-year extensions to the exemption if the water system can demonstrate that several conditions exist that prevent them from meeting the exemptions' original compliance schedule:

1. Necessary capital improvements cannot be completed within two years.
2. If the system needs financial assistance for capital improvements, the system must

have entered into an agreement to obtain the financial assistance.

3. The water system has entered into an enforceable agreement to become part of a regional water system and is taking all practical steps to comply with the arsenic MCL.

The request for an exemption must contain the following information:

1. It must list the arsenic MCL and arsenic as the contaminant for which the exemption is requested.
2. It must include sample results taken of the source water before and after any treatment.
3. It must include an explanation of the compelling factors that are preventing the water system from meeting the arsenic MCL.

There are several factors ADEQ will consider when evaluating an exemption request:

1. The necessity for construction, installation, or modification of treatment equipment.
2. The time required to install new treatment or to modify an existing treatment facility.
3. The economic feasibility of compliance.
4. The availability of alternative sources of water.
5. The opportunity for consolidation with another water system.

If ADEQ decides to grant an exemption to a water system, the system must provide its customers with the opportunity for a public hearing. Additionally, ADEQ may require the water system to provide bottled water or point of use or point of entry treatment devices as a condition of the exemption.

Non-Treatment and Treatment Options

The trend of complying with newly established environmental regulations shows that the regulated community often chooses solutions that are both economical and easier to implement and manage. There are two types of options from which affected water systems may choose in order to comply with the new arsenic standard, non-treatment and treatment options.

Non-Treatment Options

There are several options that affected water systems may choose from in order to comply with the new arsenic standard. These options are referred to in this plan as "non-treatment" options and consist of either blending treated water, modifying water sources (e.g. changing the well's screen interval), consolidating water sources, replacing water sources with new sources or becoming consecutive to another water system.

For the most part, non-treatment options tend to be more economical and easier to implement

and manage than the treatment options described below. There is a one time capital cost and minimal maintenance cost associated with the non-treatment options. The details of the non-treatment options are provided in the next chapter, Compliance Options

Treatment Options
On the other hand, there are also several treatment options or treatment technologies that affected water systems may choose from in order to comply with the new arsenic standard. Some of the treatment options are reverse osmosis (RO), activated alumina, ion exchange and lime softening. Some of these treatment technologies can be placed in the household, Point-Of-Use (POU), or prior to the distribution system. Some of these treatment technologies are also classified by EPA as Best Available Technologies (BAT).

BAT means the best technology, treatment techniques, or other means that the EPA administrator finds, after examination for efficacy under field conditions and not solely under laboratory conditions, are available (taking cost into consideration). There are a number of emerging technologies that have not yet been determined by the EPA administrator to be BATs that are showing promising results in removing arsenic. This report has looked at both BAT's and promising non-BATs with cost as a driver. Water systems should ensure any treatment technology, both BATs and non-BATs, will remove arsenic from their source water before building full scale treatment facilities. This process is referred to as "piloting" and is described later in this document.

Treatment options have the tendency to be more expensive to implement and more complicated to manage than non-treatment options. Both the capital cost and related operation and maintenance of the treatment options are expensive. The details of various treatment options are provided in the next section, Compliance Options.

Compliance Options

Overview
To assist water systems in Arizona that are affected by the Arsenic Rule, ADEQ initiated the Arsenic Master Plan (AMP) in early 2002, which included workgroups for overview, funding, compliance options and technical assistance. To assist these affected small impacted water systems, compliance options were developed to characterize systems serving less than 10,000 persons and developing costs were calculated for funding mitigation projects for the systems. The focus of the AMP is on small groundwater systems serving fewer than 10,000 persons although the report should prove useful for larger systems too. The information presented in the report, is however, useful even for large groundwater systems. The section presents the key points from the Compliance Options Report, which focuses on the mitigation techniques that were evaluated.

The major findings, discussions, conclusions and recommendations from the tasks completed to date are presented in this summary report section. The full body of the Compliance Options

Report is available as an appendix to this report.

The first section provides background information about existing water systems in Arizona, such as information on system size and system type (community systems and non-transient non community systems). The breakdown of these systems in Arizona by size and type is shown in Table ES-1.

Table ES-1: Impacted Small Systems In Arizona, by Size

System Size	Type		Total	% of Total Impacted Systems
	CWS	NTNCWS		
25-500	134	40	174	60.6
501-3,300	67	17	84	29.3
3,301-10,000	24	5	29	10.1
	225	62	287	

The outcome of the effort in this section of the report is to provide systems with a comprehensive analysis and all the information necessary for implementing treatment as a solution to elevated arsenic levels. The objectives of this project included:

- Characterizing the water quality and infrastructure of the impacted water systems; identifying follow-up monitoring requirements; to filling existing data gaps and determining future bench and pilot testing needs.
- Identifying cost-effective technologies that can be implemented at these small water systems and developing an Arizona-specific cost model for these favorable technologies.
- Determining capital and annual O&M costs for each POE of impacted utilities.
- Identifying the optimal means of complying with the future MCL for each impacted POE.
- Developing "boilerplate" facility configurations to assist water systems and ADEQ with the regulatory approval process during the design phase.
- Developing guidance on alternate compliance options such as non-treatment options (blending and well modifications) and Point-of-Use (POU) treatment.

Three main categories of arsenic treatment technologies were considered for the impacted small systems in Arizona as shown in Table ES-2. Technologies such as nanofiltration/reverse osmosis, electrodialysis reversal, Activated Alumina (AA) with on-site regeneration, and ion exchange (with and without brine recycle) were not considered due to brine disposal issues and hazardous waste considerations. Coagulation with microfiltration was not considered due to its high cost and level of complexity.

Table ES-2: Arsenic Removal Technologies for AMP

Technology	Key Implementation Factors
Coagulation with Filtration – pressurized granular media filtration process with pretreatment. Arsenic +5 removed effectively as iron particles attach to arsenic for subsequent removal by granular media or microfilter. Backwash water is 5-8% of plant flow and must be recovered on-site. Ferric chloride dose is 5 mg/l.	On-site backwash treatment is also required. Solid non-hazardous residuals generated. Ferric chloride storage and feed systems required. Hazardous waste issues not anticipated. Complete demineralization does not occur. Adjustment of pH may be required if >8.
Granular Iron Media - A fixed-bed adsorption process that utilizes granulated ferric hydroxide (GFH) or Sorb-33 removes As +5. The adsorptive capacity of GFH is 2 times greater than Fe-AA, as confirmed in recent tests conducted in Arizona. System design is similar to Fe-AA.	Interference from phosphate and silica is significant. pH impacts performance >8 but not as significantly as Fe-AA. Media used on a throw-away basis. Hazardous wastes not generated.
Iron Modified AA Media – adsorptive processes where arsenic +5 is removed with AA particles coated with iron oxides. Lab tests have shown effective removal rates and the potential for long run lengths. pH adjustment to 6.5 is required.	Additional pilot test data required to verify performance under local conditions. Some media specifications may be proprietary. Silica interference is significant. Media used on a throw-away basis. Hazardous wastes not generated.

A Web-based decision analysis tool to assist water systems in technology evaluation and selection for arsenic removal was developed and is included in the as an appendix to this report. The Web tool will assist in identifying planning-level installation and operation costs for the feasible treatment technology. Based on data input into the Web tool, the tool will also estimate the residuals generated, land required for installing the treatment systems and identify interfering source water parameters in terms of corrosion issues in the distribution system.

Impacted Water Systems

This section provides information about system classification based on average population criteria. Systems serving less than 10,000 persons were classified as small water systems and those serving greater than 10,000 persons were classified as large water systems. Based on ADEQ's 1993-2001 sampling database, POEs characterized by an average arsenic standard of 10 ppb were considered impacted systems and were classified according to system size (Table ES-3). Out of the 793 impacted POEs, 60% (473 POEs) belonged to systems serving fewer than 10,000 persons, and 29% (231 POEs) belonged to very small systems (systems serving less than 500 persons). Most impacted systems have groundwater sources, but a small number of surface water systems identified. However, the surface water systems were not considered in the AMP, under the assumption that existing treatment processes at these impacted POEs can be optimized to comply with the arsenic MCL.

Table ES-3: Summary of System Sized and Impacted POEs

System Size	Number of Impacted POEs
Large systems - breakdown of impacted POEs by size	
>10,000 - 50,000	95
>50,000 - 100,000	21
>100,000	104
	220 Total Large System POEs
Small systems - breakdown of impacted POEs by size	
0-500	231
>500 - 3,300	151
>3,300 - 10,000	91
	473 Total Small System POEs
Total All Systems	793 Total POEs

Water Quality Data Assessment

This section provides a description of the source water quality at the impacted POEs identified in the previous section. A list of competing contaminants for arsenic removal and the levels at which these contaminants are of concern are discussed. It was observed that out of 473 affected POEs, water quality data was available for 260 POEs. Eight primary categories of water quality profiles were developed based on arsenic, pH and fluoride data, as shown in Table ES-4. These have significant impact on treatability and selection of treatment technologies. Additional information was included for chloride, silica, sulfate, TDS, phosphorus, iron and manganese. These other contaminants affect arsenic removal, and an understanding of the presence and concentration of these parameters also is needed to evaluate arsenic treatment options and costs. Due to limited data on phosphorus, iron and manganese, they were not used in the water quality profile classification. Each impacted POE was assigned to one of the eight particular water quality profiles. Additional sampling was recommended to obtain water quality data for silica, phosphorus, iron and manganese to further ascertain water quality impacts on treatment profiles at the impacted POEs.

Table ES-4: Water Quality Profile Groups

GROUP	CLASSIFICATION
1A	Arsenic <= 20 ppb, pH <= 8, Fluoride <= 2 mg/L
1B	Arsenic <= 20 ppb, pH > 8, Fluoride <= 2 mg/L
2A	Arsenic <= 20 ppb, pH <= 8, Fluoride > 2 mg/L
2B	Arsenic <= 20 ppb, pH > 8, Fluoride > 2 mg/L
3A	Arsenic > 20 ppb, pH <= 8, Fluoride <= 2 mg/L
3B	Arsenic > 20 ppb, pH > 8, Fluoride <= 2 mg/L
4A	Arsenic > 20 ppb, pH <= 8, Fluoride > 2 mg/L
4B	Arsenic > 20 ppb, pH > 8, Fluoride >2 mg/L

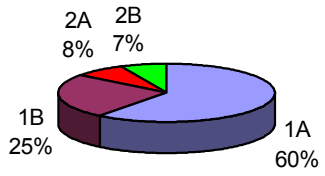
In the tables in the appendix, flags were added for the following source water contaminants if the indicated concentration thresholds were exceeded:

- Silica > 50 mg/L
- Chloride >200 mg/L
- Sulfate >200 mg/L
- TDS > 750 mg/L
- Phosphorus > 0.2 mg/L
- Iron > 0.05 mg/L and manganese > 0.5 mg/L

Based on the analysis, 13 POEs were characterized impacted by source water containing silica >50 mg/L and fluoride >2 mg/L, which affects Fe-AA treatment. Twenty POEs were characterized impacted by source water containing pH >8.0 and phosphorus >0.2 mg/L, which affects GFH treatment.

The water quality profile groups were classified based on system size into three categories, as shown in Table ES-5. Figures ES-1 and ES-2 represent water quality profile groups for low arsenic content systems (As <20 ppb) and high arsenic content systems (As >20 ppb). Most of the high and low arsenic content systems had a water quality profile with pH levels below 8 and fluoride levels <2 mg/L, making the water more amenable to adsorption.

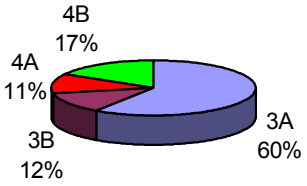
Figure ES-1: Water Quality Profiles for Low Arsenic Systems (<20 ppb As)



1A Arsenic <=20, pH <=8, Fluoride <=2
1B Arsenic <=20, pH >8, Fluoride <=2
2A Arsenic <=20, pH <=8, Fluoride >2
2B Arsenic <=20, pH >8, Fluoride >2

129 POEs <10,000 total for which data was available

Figure ES-2: Water Quality Profiles for High Arsenic Systems (>20 ppb As)



3A Arsenic >20, pH <=8, Fluoride <=2
3B Arsenic >20, pH >8, Fluoride <=2
4A Arsenic >20, pH <=8, Fluoride >2
4B Arsenic >20, pH >8, Fluoride >2

131 POEs <10,000 total for which data was available

Table ES-5: Matrix of Water Quality Profile Classification Based on System Size

System Size	# of Systems Per Water Quality Profile Group							
	1A	1B	2A	2B	3A	3B	4A	4B
0-500	28	11	5	5	33	8	11	10
w/Si Flag	2	0	0	1	7	1	1	2
w/TDS Flag	12	2	2	1	11	2	6	4
w/SO4 Flag	3	1	1	0	5	2	1	1
w/Chloride Flag	1	1	1	1	1	1	4	2
>500-3300	25	9	2	3	31	3	4	9
w/Si Flag	4	2	1	0	5	0	0	1
w/TDS Flag	4	1	0	2	6	1	0	6
w/SO4 Flag	1	0	0	0	0	1	0	2
w/Chloride Flag	1	0	0	0	0	0	0	3
>3300-10,000	25	12	3	1	14	5	0	3
w/Si Flag	6	0	0	0	2	0	0	0
w/TDS Flag	0	1	0	0	1	0	0	3
w/SO4 Flag	1	0	0	0	0	0	0	0
w/Chloride Flag	0	0	0	0	0	0	0	0

Treatment Alternatives and Cost Models

This section gives a detailed discussion of the potential arsenic removal technologies for small water systems and the associated costs. Iron-modified activated alumina (Fe-AA) (single vessel or two vessels in series), granular iron media such as granular ferric hydroxide (GFH) or Sorb-33 (single vessel or two vessels in series), coagulation with granular media filtration and POU devices (reverse osmosis and adsorption media) were determined as the feasible treatment options. Several sub-options were developed for each treatment alternative, based on water quality criteria, potential for partial stream treatment and level of redundancy required. Partial stream treatment can be implemented when the raw water arsenic level is slightly above the MCL. Only a portion of the flow is treated, while the remaining flow is bypassed and blended back with the treated flow. The advantages of partial stream treatment include lower pressure ratings for the treatment system, lower treatment costs, smaller facilities and reduced O&M costs. Detailed information on site plans and schematics, and design criteria for each treatment alternative, are presented in the report. Cost models were developed for varying configuration options and media type, using Arizona specific cost models. Based on the cost models, capital and O&M costs were estimated for each category. An example model of the schematic, design criteria and cost calculations for the two most feasible treatment alternatives are presented later in this section.

Alternatives 1a and 2a

For systems with inflect arsenic levels <15 ppb, the two feasible alternatives are single vessel treatment, using Fe-AA and single vessel treatment using granular iron media. The column is operated to 8-10 ppb breakthrough of arsenic, after which the media is replaced. Partial stream treatment is not possible for these alternatives. These two alternatives are very economical for small systems, especially for backup or peaking wells. These alternatives are further sub-divided as follows:

1a Single vessel Fe-AA treatment with pH adjustment to 6.5. The full flow is treated as the well directly pumps into the system under pressure without a storage tank at the POE site.

1b Single vessel Fe-AA treatment with pH adjustment to 6.5. The full flow is treated as the well pumps into an existing on-site storage tank for subsequent repumping into the system. A lower pressure rating is used for this treatment system.

2a Single vessel granular iron media treatment without pH adjustment. The full flow is treated as the well directly pumps into the system under pressure without a storage tank at the POE site.

2b Single vessel granular iron media treatment without pH adjustment. The full flow is treated as the well pumps into an existing on-site storage tank for subsequent repumping into the system. A lower pressure rating is used for this treatment system.

Alternatives 3a and 4a

Two columns in series treatment using Fe-AA or granular iron media is recommended for systems where a well is the primary source of water and extended outages cannot be tolerated. Partial stream treatment is possible. Each column is operated to greater than 10 ppb breakthrough of arsenic before the media is replaced. Five categories of classification under Fe-AA treatment are as shown below:

3a Two column Fe-AA treatment with pH adjustment to 6.5, for wells with inflect As >20 ppb, the full flow is treated as the well directly pumps into the system under pressure without storage at the POE site.

3b Two column Fe-AA treatment with pH adjustment to 6.5, for wells with inflect As >20 ppb, the full flow is treated as the well pumps into an existing on-site storage tank for subsequent repumping into the system.

3c Two column Fe-AA treatment with pH adjustment to 6.5. Partial stream treatment, where feasible (inflect As <20 ppb), for wells pumping into an existing on-site storage tank for subsequent repumping into the system.

3d Two column Fe-AA treatment with pH adjustment to 6.5. Partial stream treatment, where feasible (inflect As <20 ppb), for wells pumping into a new on-site storage tank for subsequent repumping into the system using new booster pumps.

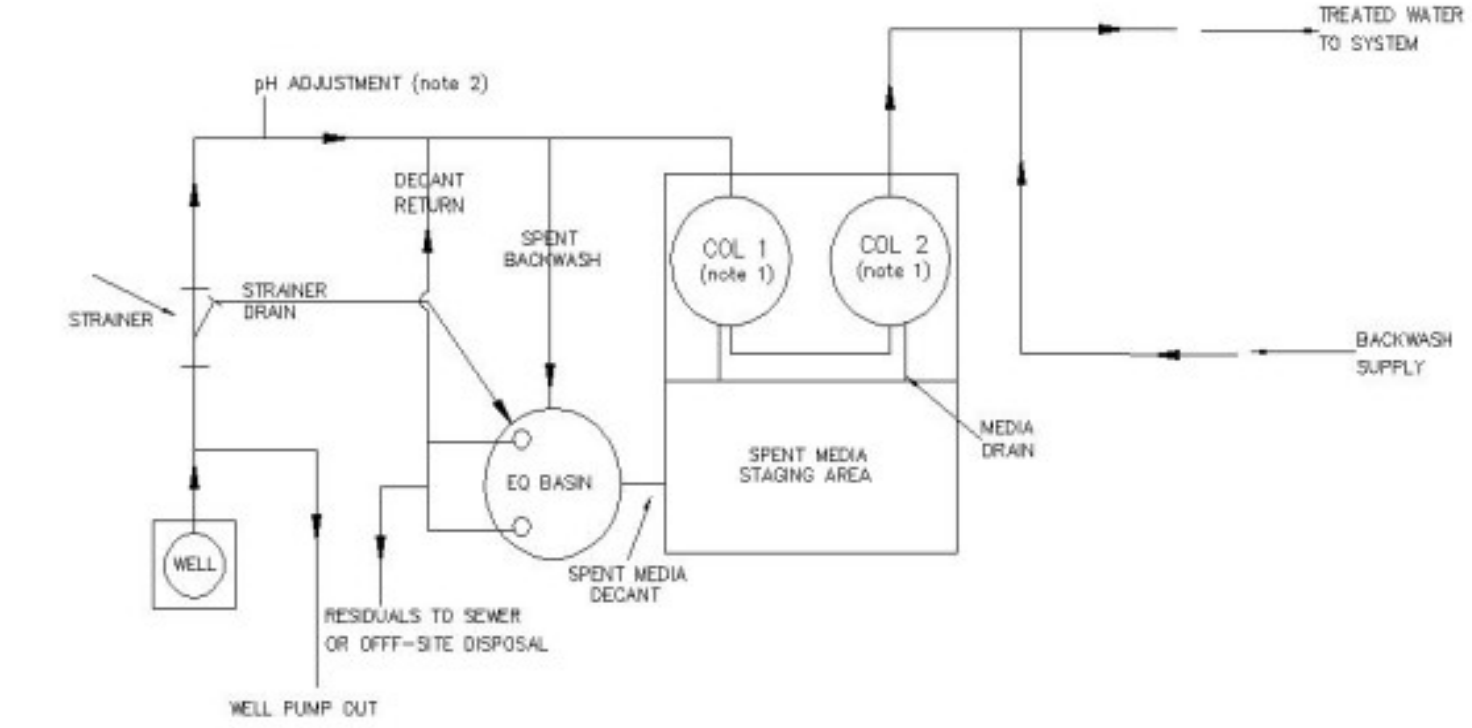
3e Two column Fe-AA treatment with pH adjustment to 6.5. Partial stream treatment, where feasible (inflect As <20 ppb), direct pumping into the system under pressure without storage at the POE site (risky and control intensive option – this alternative was not used in the master plan).

The system design criteria for Alternatives 3a and 3b are shown in Table ES-6. The schematic for Alternative 3a is shown in Figure ES-3.

Table ES-6: System Design Criteria for Two Column Fe-AA Treatment (3a and 3b)

Parameter	Units	Value
Flow	gpm	21-1389
Average Inflect Arsenic Level	ppb	25
No. of Treatment Vessels		2
Vessel Configuration		series
EBCT (each vessel)	min	5
Vessel Diameter	ft	2-12
Media Depth	ft	4
Vessel Height (side shell)	ft	7.5
Operating Pressure	psi	100 (Alternative 3a) 50 psi (Alternative 3b)
Maximum Headloss	psi	20
Operating pH	std. units	6.5
Operating time until arsenic breakthrough[1]	days	105
Acid/Caustic facilities required?		Yes[2]
Backwash Equalization Basin	BVs	8
Backwash Disposal		Landfill
Backwash Frequency		Monthly
Clearwell Detention Time	min	10

[1]Media replacement interval based on continuous operation
[2]pH adjustment necessary for Fe-AA based on pilot testing data



ALTERNATIVES
3A & 4A

NCS

FIGURE ES-3

An example of estimated capital and O&M costs for Alternative 3a are shown in Tables ES-7 and ES-8. These estimated costs were plotted as a function of system design flow to develop capital and O&M cost curves to estimate costs for systems with various capacities throughout Arizona. The capital and O&M cost curves for Alternative 3a are shown in Figures ES-4 and ES-5.

Table ES-7: Estimated Capital Costs for Alternative 3a (Two Column Treatment with Fe-AA – direct pumping into system)

	Capacity in MGD					
Fe-AA System Facilities Costs	0.03	0.1	0.2	0.5	1.0	2.0
Booster Pumping/ Straining	$7,500	$7,500	$8,550	$18,000	$28,000	$32,000
Residuals Handling Facilities	$3,267	$8,956	$13,711	$39,149	$63,778	$71,398
Fe-AA System Facilities	$49,414	$64,713	$106,025	$161,563	$254,126	$646,251
Chemical Feed Faciliites	$10,854	$17,979	$33,358	$66,495	$122,590	$237,380
Building	$32,000	$32,000	$32,000	$38,400	$51,840	$108,000
Piping, I&C, Electrical, Yard Piping Allowances	$28,414	$39,659	$64,658	$114,083	$187,397	$394,812
Total Facility Cost, $	$131,448	$170,806	$258,302	$437,689	$707,731	$1,489,841
Contingency, 20%	$26,290	$34,161	$51,660	$87,538	$141,546	$297,968
Taxes & Bonding, 8.5%	$13,408	$17,422	$26,347	$44,644	$72,189	$151,964
Total Estimated Fe-AA Facility Cost	$171,145	$222,389	$336,309	$569,872	$921,466	$1,939,773

Table ES-8: Annual O&M Costs for Alternative 3a (Two Column Treatment with Fe-AA - direct pumping into system)

	Capacity in MGD					
Facility assumed to operate 100% of time	0.03	0.1	0.2	0.5	1.0	2.0
Annual Power Cost, $/yr	$539	$1,617	$2,694	$2,828	$5,637	$8,446
H2SO4 Cost, $/yr	$137	$457	$913	$2,283	$4,566	$9,132
NaOH Cost, $/yr	$310	$1,035	$2,070	$5,175	$10,350	$20,700
Annual Media Replacement Costs, $/yr	$4,110	$13,698	$27,397	$68,492	$136,985	$273,969
Media Replacement Service Cost, $	$2,500	$2,500	$5,000	$8,000	$10,000	$15,000
Waste Media Disposal Costs, $/yr	$301	$1,005	$2,009	$5,023	$10,046	$20,091
Total Estimated Labor Costs, $/yr	$2,059	$2,059	$4,493	$8,299	$8,299	$8,299
Equipment Maintenance Costs, $/yr	$1,711	$2,224	$3,363	$5,699	$9,215	$19,398
Arsenic Analysis cost, $/yr	$90	$90	$90	$90	$90	$90
Total Estimated Annual O&M Costs, $/yr	$9,258	$22,185	$43,030	$97,889	$185,187	$360,126
Unit Annual O&M Costs, $/1000 gal	$0.85	$0.61	$0.59	$0.54	$0.51	$0.49

Figure ES-4: Total Capital Costs for Fe-AA (Alternative 3a)

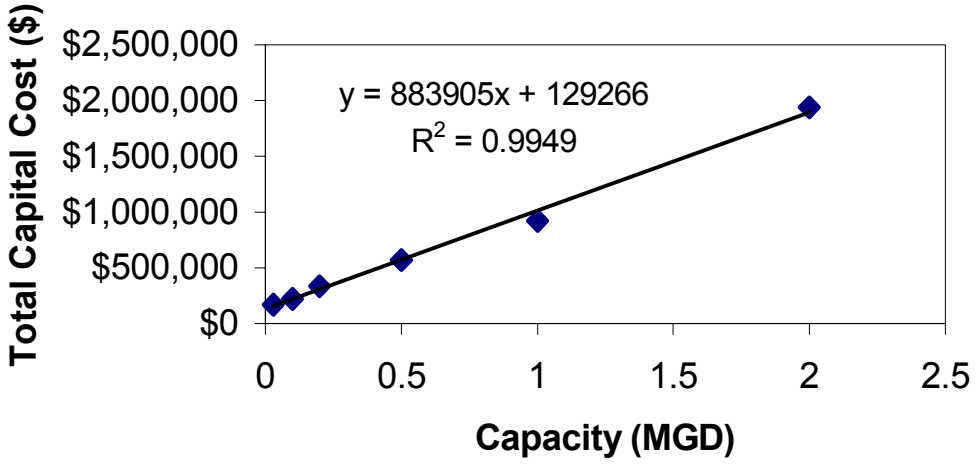
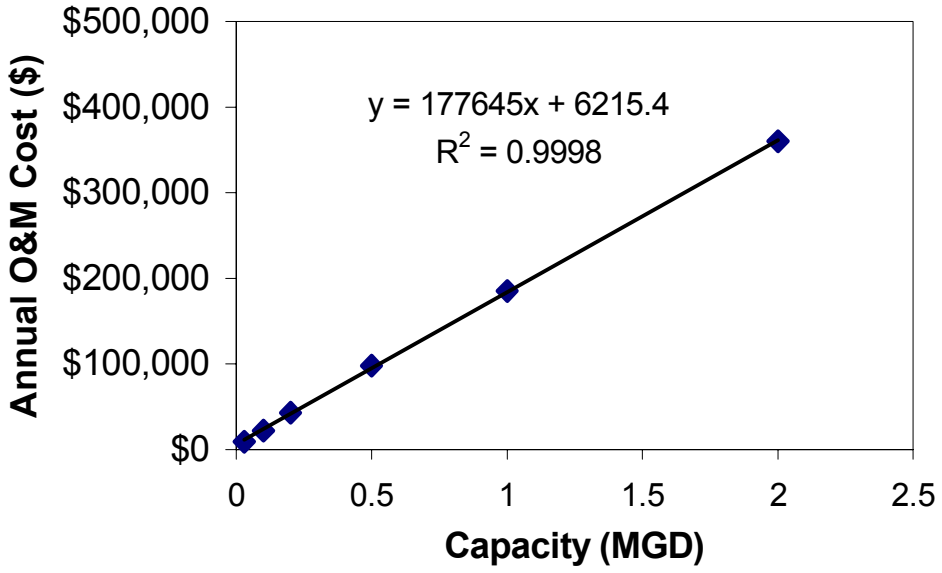


Figure ES-5: Total Annual O&M Costs for Fe-AA (Alternative 3a)



Five categories of classification under granular iron media treatment were identified as follows:

4a Two column granular iron media treatment without pH adjustment, for wells with inflect As >20 ppb, the full flow is treated as the well directly pumps into the system under pressure without storage at the POE site.

4b Two column granular iron media treatment without pH adjustment, for wells with inflect As >20 ppb, the full flow is treated as the well pumps into an existing on-site storage tank for subsequent repumping into the system.

4c Two column granular iron media treatment without pH adjustment. Partial stream treatment, where feasible (inflect As <20 ppb), for wells pumping into an existing on-site storage tank for subsequent repumping into the system.

4d Two column granular iron media treatment without pH adjustment. Partial stream treatment, where feasible (inflect As <20 ppb), for wells pumping into a new on-site storage tank for subsequent repumping into the system using new booster pumps.

4e Two column granular iron media treatment without pH adjustment. Partial stream treatment, where feasible (inflect As <20 ppb), direct pumping into the system under pressure without storage at the POE site (risky and control intensive option – this alternative was not used in the Arsenic Master Plan).

The system design criteria for Alternatives 4a and 4b are shown in Table ES-9. The schematic for Alternative 4a is shown in Figure ES-3.

Table ES-9: System Design Criteria for Two Column Granular Iron Media (Alternatives 4a and 4b)

Parameter	Units	Value
Flow	gpm	21-1389
Average Arsenic Level	ppb	25
No. of Treatment Vessels		2
Vessel Configuration		series
EBCT (each vessel)	min	2.5
Vessel Diameter	ft	2-12
Media Depth	ft	2.7
Vessel Height (side shell)	ft	6
Operating Pressure	psi	100 (Alternative 4a) 50 (Alternative 4b)
Maximum Headloss	psi	20
Maximum Operating pH	std. units	8.0
Operating time until arsenic breakthrough[1]	days	107
Acid/Caustic facilities required?		No[2]
Backwash Equalization Basin	BVs	13
Spent Media Disposal		Landfill
Backwash Frequency		Monthly
Clearwell Detention Time	min	10

[1]Media replacement interval based on continuous operation
[2]pH adjustment not necessary for granular iron media for waters up to pH 8.0

An example of estimated capital and O&M costs for Alternative 4a are shown in Tables ES-10 and ES-11.

Table ES-10: Estimated Capital Costs for Alternative 4a (Two Column Treatment Using Iron Media – Direct Pumping into System)

	Capacity in MGD					
GFH System Facilities Costs	0.03	0.1	0.2	0.5	1.0	2.0
Residuals Handling Facilities	$2,954	$7,914	$11,628	$36,545	$58,569	$66,189
Booster Pumping/ Straining	$7,500	$7,500	$8,550	$18,000	$28,000	$32,000
GFH System Facilities	$51,008	$70,027	$116,053	$215,734	$348,667	$697,335
Building	$32,000	$32,000	$32,000	$38,400	$51,840	$108,000
Piping, I&C, Electrical, Yard Piping Allowances	$24,585	$34,176	$54,493	$108,111	$174,095	$318,210
Total Facility Cost, $	$118,047	$151,617	$222,724	$416,790	$661,172	$1,221,734
Contingency, 20%	$23,609	$30,323	$44,545	$83,358	$132,234	$244,347
Taxes & Bonding, 8.5%	$12,041	$15,465	$22,718	$42,513	$67,439	$124,617
Total Estimated GFH Facility Cost	$153,697	$197,405	$289,986	$542,660	$860,845	$1,590,698

Table ES-11: Annual O&M Costs for Alternative 4a (Two Column Treatment Using Iron Media – Direct Pumping into System)

	Capacity in MGD					
Facility assumed to operate 100% of time	0.03	0.1	0.2	0.5	1.0	2.0
Annual Power Cost, $/yr	$539	$1,617	$2,694	$2,826	$5,635	$11,253
Annual Media Replacement Costs, $/yr	$6,849	$22,831	$45,662	$114,154	$228,308	$456,615
Media Replacement Service Cost, $	$2,500	$2,500	$5,000	$8,000	$10,000	$15,000
Waste Media Disposal Costs, $/yr	$120	$264	$540	$1,320	$2,640	$5,280
Total Estimated Labor Costs, $/yr	$2,059	$2,059	$4,493	$8,299	$8,299	$8,299
Equipment Maintenance Costs, $/yr	$1,537	$1,974	$2,900	$5,427	$8,608	$15,907
Arsenic Analysis cost, $/yr	$60	$60	$60	$60	$60	$60
Total Estimated Annual O&M Costs, $/yr	$13,664	$31,304	$61,349	$140,085	$263,550	$512,414
Unit Annual O&M Costs, $/1000 gal	$1.25	$0.86	$0.84	$0.77	$0.72	$0.70

Alternative 5 – Coagulation with Granular Media Filtration

Coagulation with granular media filtration (CF) is recommended for large treatment plants (>1 MGD), particularly those with higher inflect arsenic levels (>20 ppb) and that also have a higher degree of operator expertise. Partial stream treatment is not possible. This alternative can be sub-divided into the following two categories:

5a Direct pumping into the system under pressure without storage at the POE site.

5b Pumping into an existing on-site storage tank for subsequent repumping into the system. A lower pressure rating is used for this treatment system.

Alternative 6 – Point of Use Devices

For systems serving fewer than 100 connections and an average population of less than 300, Point

of Use (POU) or single tap treatment is recommended as it offers ease of installation, treats only water used for human consumption (about 2% of a system's total flow), has lower initial capital costs and reduces the engineering costs associated with construction of a full-scale treatment plant. The feasible POU treatment alternatives are:

6a POU treatment using adsorption (Mn-AA or iron media)

6b POU treatment using reverse osmosis (RO)

Cost Assessment

This section presents a summary of the most favorable and cost-effective arsenic removal technologies for the 473 impacted POEs in Arizona. Costs were computed for each POE or wellhead that requires treatment. A feasibility assessment and cost comparison was performed to determine the most appropriate and lowest cost options. Total treatment costs, on a statewide basis, were determined taking into consideration system size and the least cost option. A feasibility assessment of non-treatment options (by blending water from multiple POEs) and POU treatment was also performed to determine which systems should further consider these options.

Based on the information from the ADEQ drinking water database and survey responses, it was observed that current facility configuration and infrastructure information was available for 349 of the 473 impacted POEs. POE flow data was not available for 124 POEs. Necessary assumptions were made in determining the missing flow and facility configuration data.

A technology feasibility assessment was performed to determine the feasibility of various treatment alternatives on an individual POE basis.

- Feasibility of using single vessel treatment based on raw water arsenic levels of less than 15 ppb: Alternatives 1a, 1b, 2a and 2b are feasible only if raw water arsenic levels are at or below 15 ppb.
- Feasibility of partial stream treatment: Alternatives 3c, 3d, 3e, 4c, 4d and 4e are not feasible for small POEs with flows <0.5 MGD due to complex controls and additional costs for piping and flow splitting. These alternatives are also not feasible if the inflect arsenic concentrations exceed 20 ppb.
- Feasibility of installing additional storage tanks for partial stream treatment: Alternatives 3d and 4d are not feasible where sufficient land is not available to construct a new clearwell necessary for partial stream treatment.
- Feasibility of CF technology: Alternatives 5a and 5b are not feasible unless the flow is at least 1 MGD and sufficient land area is available.
- Feasibility of POU treatment: Alternative 6 is not feasible unless the system size is less than 100 connections (300 persons served).

Systems with water quality characteristics that may interfere with arsenic removal efficiency were also identified. Systems affected by high fluoride (>2 mg/L) or high silica (>50 mg/L) should not

use Fe-AA as an effective treatment methodology alternative (Alternative 1a, 1b, 3a, 3b, 3c, 3d). Similarly, source water having high pH (>8.0) or high phosphorus (>0.2 mg/L) should not use GFH as an effective treatment alternative (Alternatives 2a, 2b, 4a, 4b, 4c, 4d).

Cost Evaluation on a Statewide Basis

Capital and O&M costs were developed on a statewide basis for each of the feasible alternatives using cost equations developed in the section on treatment alternatives and cost models. From the feasible options, the two lowest cost options, from an annualized treatment cost perspective were selected (annualized cost = capital cost amortized over 20 years at a 6% differential interest rate + annual O&M cost). A list of the two lowest cost options, including capital and O&M costs for each of the 473 impacted POEs and the monthly cost increase per household (for the lowest cost option), is presented in Table ES-12. The AMP recommends the use of these two lowest cost options as arsenic mitigation strategies. A summary of the statewide costs are shown below:

	Lowest cost option	Second lowest cost option
Total Capital Cost	$109,700,000	$103,200,000
Total O&M Cost	$14,200,000	$20,300,000
Total Annualized Cost	$24,100,000	$29,300,000

These cost estimates do not include the engineering fees for design of these facilities. A 30% factor should be used to estimate the engineering fees. It was observed that Fe-AA with pH adjustment was generally the lowest cost option and granular iron media without pH adjustment was the second lowest cost option. The trade off between lower capital costs and increased O&M costs (for increased media costs) should be considered in selecting the appropriate treatment option. The use of CF technology and partial stream treatment was limited, as most impacted POEs were smaller than 1 MGD. A summary of the most feasible treatment technologies, on a systemwide basis, based on lowest cost option and second lowest cost option is shown in Table ES-13.

Table ES-13: Overall Treatment Technology Selection Based on Cost Options

Treatment Technology	Number of Impacted POEs	
	Lowest Cost Option	Second Lowest Cost Option
1a	110	10
1b	29	3
2a	6	108
2b	4	30
3a	264	4
3b	38	2
3c	1	0
3d	8	0
4a	7	271
4b	4	41
4c	0	0
4d	0	4
5a	2	0
5b	0	0
Total Lowest Capital Cost	$109,700,000	$103,200,000
Total O&M Cost	$14,200,000	$20,300,000
Total Annualized Cost	$24,100,000	$29,300,000

Non-treatment options (blending without treatment) should be evaluated on a site-specific basis for POEs that are within 1 mile of another POE in the same system. Approximately 30 systems had POEs that were within 1 mile of each other, which might result in additional costs savings by blending water from nearby POEs.

Systems serving fewer than 300 persons should consider the possibility of using POU treatment as significant capital cost savings, ranging from 5 to 20 percent of centralized treatment costs, may be incurred. Based on a comparison between centralized (Alternative 1a) and POU treatment costs (using activated alumina (POU AA) and reverse osmosis (POU RO) techniques), it was observed that POU RO and POU AA costs were significantly lower than centralized treatment costs for systems serving fewer than 30 connections. For these systems, POU RO annualized costs were $13,518, POU AA annualized costs were $12,245 and central annualized treatment costs were $26,580. As the number of connections increased, the POU costs also increased gradually and the breakpoint cost was observed at 80 connections for POU RO and at 90 connections for POU AA. The monthly cost increase per household was $37 for POU RO and $34 for POU AA, both of which were less than centralized treatment cost increase per month until 80 and 90 connections respectively. Based on a statewide POU evaluation, it was observed that approximately 64 POEs with average population less than 300 persons had annualized POU costs lower than the lowest central annualized treatment costs. These POEs should be further

evaluated on a site-specific basis for POU feasibility, taking into consideration political and logistic issues associated with POU treatment.

Funding Resources

Overview

As mentioned previously, this document has focused on small water systems, although the information contained in this section should also prove useful for large systems. Many small water systems currently have no treatment facilities, however the newly established arsenic standard is likely to change that for the systems addressed in this document. Systems that previously had no treatment facilities will, as a result of the arsenic rule, be installing and operating water treatment facilities for the first time. In order to comply with the arsenic rule most if not all affected systems will need to obtain financial assistance for the construction of arsenic treatment facilities.

There are currently a variety of methods a water system can use to finance water treatment facility construction and operation expenses. These methods range from obtaining grants or loans to issuing bonds. While the sources for funding water treatment plant expenses are somewhat limited compared to some other industries, there are options available to small water systems to assist them in achieving compliance with the arsenic standard. Regardless of the funding mechanism a water system selects, it will be necessary for the system to ensure their financial capacity is adequate to allow debt service repayment.

Methods for Analyzing Financial Capacity

A water systems financial capacity is based on a several factors. These factors include the income the system generates monthly and annually to support its operation, the amount of working capital the system has, the amount of capital improvement reserve the system sets aside, the operating ratio of the system, and the coverage ratio of the system. Do not be alarmed if these terms are not familiar to you. We have incorporated a financial analysis tool developed by the **Missouri Department of Natural Resources (MDNR)** that explains what these terms mean and how they related to your systems financial capacity. This tool is extremely powerful and can be used to benchmark the financial condition of your system and also to help you identify where your system needs to be financial in the future as well as how to get there. It is important that water systems position themselves to be financially capable of maintaining compliance with the drinking water requirements. This financial analysis tool may appear overwhelming to some smaller water systems. ADEQ is currently scheduling training for staff and other technical assistance providers who will then conduct intensive training session and provide one-on-one assistance to water systems throughout 2003 and beyond.

Adjusting Rates to Incorporate Arsenic Compliance Costs

Many water systems will need to adjust their rate structure in order to pay for the compliance measures necessary to meet the new arsenic MCL. In the compliance options section of this report we have included cost estimates for each water system based on our analysis of feasible

technologies. We also included the estimated monthly increase in user fees for the preferred technology identified for your system (see Table 5.3 of the compliance options section). It is our belief these cost estimates are accurate and can be used for planning purposes by your system. To use these two tools you should first determine how you plan to comply with the arsenic regulation. You should then use the MDNR financial analysis tool to determine the current financial capacity of your system. You can then use the MDNR tool to determine the financial capacity your system will need to support compliance with the arsenic standard. You can find the recommended arsenic treatment option identified through the ADEQ analysis in Table 5.3 of this report. Included in the MDNR tool are a series of bar charts, graphs and pie charts that illustrate your systems financial capacity and how those funds are each aspect of your water system. These charts and graphs are excellent visual tools that can be used when communicating the financial needs of your system both in the present and future.

Water System Regulated by the Arizona Corporation Commission (ACC)

If your water system is regulated by the ACC you are probably already aware of the process you must use to adjust your rate structure. If you are regulated by the ACC and you are not familiar with the rate adjustment process you can obtain additional information by accessing the ACC Web site at www.cc.state.az.us/utility/water or by calling them at (602) 542-4251. It is very important that you begin the process of adjusting your rates for arsenic compliance costs as soon as possible. This will ensure that your rate case will be processed with adequate time left for your system to complete capital improvements prior to the January 23, 2006 compliance deadline.

Water Systems Not Regulated by the Arizona Corporation Commission

If your water system is not regulated by the ACC you likely have a rate structure that operates off a monthly or annual assessment. Also some water systems may operate off donations made by users when expenses arise. Despite these varying methods of generating revenue from users, a water system will need to have a consistent and steady flow of revenue to qualify for any financial assistance. It is through this demonstration of a consistent revenue stream that a lending institution makes a decision and determines the amount of money the system can afford to borrow as well as the ability to make loan payments over time.

Financial Assistance Organizations for Water Systems

There are a few financial assistance organizations that specialize in financing water system infrastructure projects. A brief description of three of these organizations is presented below with the types of water systems eligible for assistance and a contact phone number.

Water Infrastructure Finance Authority (WIFA)

WIFA is a state agency authorized to finance the construction, rehabilitation and/or improvement of drinking water, wastewater, wastewater reclamation or other water quality facilities/projects. Generally, WIFA offers borrowers below market interest on loans for 100% of eligible project costs. Because WIFA is a "bond bank" by pooling different entities financing needs. WIFA can provide significant savings through reduced borrowing amounts, lower interest rates, and shared or reduced closing costs. WIFA also provides low interest financial assistance by

tapping the Drinking Water Revolving Loan Fund (DWSRF), a fund that consists of contributions from both the state and U.S. Congress. Both public and privately held water systems are eligible for financial assistance from WIFA. WIFA has developed a simplified application for water systems to use when seeking financial assistance. A copy of this application, as well as additional information on WIFA, can be found by accessing their Web site at www.wifa.state.az.us or by calling (602) 364-1310.

United States Department of Agriculture – Rural Utilities Service – Arizona Rural Development

Arizona Rural Development (RD) administers a water and wastewater loan and grant program to improve the quality of life and promote economic development in rural America. In addition to loans and grants, RD offers technical assistance, both directly and through contractors, and grants to nonprofit organizations. Direct loans may be made to develop water and wastewater systems in rural areas and to cities and towns with a populations of 10,000 or less. Funds are available to public entities, such as municipalities, counties, special purpose districts, Indian tribes, and corporations operated on a not-for-profit basis. Priority is given to public entities, in areas with less than 5,500 people, to restore deteriorating water supply, or to improve, enlarge, or modify a water facility. Also, preference is given to requests that involve the merging of small facilities and those serving low-income communities. Guaranteed loans may be made for the same purposes as direct loans. A guaranteed loan is one in which a third party, such as RD, guarantees a loan with a second party, such as a bank, who then lends the money to a water system. Guaranteed loans are made and serviced by lenders such as banks and savings and loan associations. Guarantees are available for up to 90 percent on any loss of interest and principle on the loan. A direct loan is one in which a lending institution lends money directly to the applicant. Additional information on RD can be found by accessing their Web site at www.usda.gov/rus/water.

Border Environmental Cooperation Commission – North American Development Bank

The Border Environmental Cooperation Commission (BECC) purpose is to help preserve, protect and enhance the environment of the border region in order to advance the well-being of the people of the United States and Mexico. BECC coordinates with the North American Development Bank (NADBank), other national and international institutions, and private sources that provide capital for environmental infrastructure projects in the border region. Water projects receive priority under BECC. The project must be located within 62 miles (100 kilometers) of the international border to be eligible for BECC/NADBank funds. Additional information on BECC/NADBank can be found by visiting their Web site at www.cocef.org/englishbecc.html.

Technical Assistance

Mentoring Program

Levels of expertise varies among different sized systems, a small system may not have the needed expertise or adequate resources to comply with the new arsenic standard. As a result, the AMP stakeholders proposed to include a mentoring program in the AMP, which ADEQ strongly supports.

As drinking water regulations become more and more complex the opportunity for valuable mentoring between large water systems (those serving more than 50,000 persons) and small water systems (those serving fewer than 10,000 persons) increases. There are currently more than 90 regulated contaminants and a multitude of monitoring and reporting frequencies both large and small water systems must meet. Additionally, the complexity of new regulations are certain to require small water systems to tap expertise and knowledge not previously needed in their day-to-day operations.

State and federal regulators continue to search for ways to improve small water system operator knowledge and technology transfer. The goal of enabling small water systems to obtain and utilize the knowledge and technology necessary for successful operation of water systems will be accomplished more quickly and completely through partnerships between large and small water systems.

It is common that professionals involved in the Safe Drinking Water industry forma networks of professionals whose goal is to ensure citizens served by public water systems receive safe and clean drinking water. This is demonstrated in many ways ranging from participation in state and national industry organizations, engaging in Safe Drinking Water policy and research development, and the efforts to ensure individual water systems are managed and operated in the best possible manner. Added to these traditional efforts, professionals mentoring is a very fruitful opportunity for industry professionals to use in meeting our collective safe drinking water goal of ensuring every Arizonan receives safe and clean drinking water.

Success of a mentoring program relies on water system professionals' commitment to dedicate resources and expertise to raise the industry's base of knowledge, not only within their own water utility but also in water utilities throughout the state. There will be many mentoring activities a water utility can engage in; and it is not necessary for a utility to engage in all of them to become a mentor. In order to facilitate a successful statewide mentoring program, ADEQ will serve as coordinator by providing support and direction.

Mentoring Activities

Rapid Information Provider (RIP) Team
The RIP team will be a clearinghouse of industry experts that water systems across Arizona can access for immediate technical assistance and advice in emergency situations. The team will consist of 10 members with expertise ranging from operational to regulatory compliance.

1. Grade 4 water treatment operator
2. Grade 4 water distribution operator
3. Grade 2 water treatment operator
4. Grade 2 water distribution operator
5. Compliance/regulatory affairs manager from a large water system
6. Utilities Department manager from a large system
7. State drinking water regulatory official
8. Public health/risk assessment professional
9. Drinking water association official
10. Public information professional

RIP team members will be selected by ADEQ to serve a one year term. RIP team members will be asked to be available for consultation during business hours throughout their term. Additionally, RIP team members will be asked to participate in bi-monthly meetings and to provide review and comment of guidance documents for use by water systems facing emergency situations. ADEQ will provide administrative support for the RIP team and will provide a call in number for water systems to access technical assistance and advice from the RIP team.

During bi-monthly meetings RIP team members will discuss incidents that have occurred and involved RIP team response to continually improve the service provided by the RIP team and to identify opportunities for development of guidance documents. RIP team meeting minutes will be forwarded to mentoring water systems for their use in refining and targeting their overall mentoring activities.

Associating Mentors with Water Systems
ADEQ is developing an application that water systems wishing to receive mentoring assistance will need to complete before being accepted to the program. The application will gather basic information about candidate water systems including management structure, technologies in place, compliance issues, level of technical expertise of staff, location and facility specifics such as type and number of sources, storage capacity, system configuration, service area size, etc.

ADEQ will collect completed applications and review them to identify trends or categories of mentoring needs based on the information submitted. If possible, systems will be grouped by similar mentoring needs, which may help mentors in selecting partners.

ADEQ will also circulate a survey to all large water systems asking them to indicate their

willingness to become a mentor. The survey will include a description of the types of assistance and activities a mentor system would be expected to provide. A general list of these include:

1. Water system management
2. Water system planning
3. Rate setting
4. Development of capital improvement plans
5. Water system operations
6. Regulatory compliance
7. Engineering and facility construction
8. Laboratory capabilities

A comprehensive list will be assembled once surveys from both systems seeking mentoring and systems willing to provide mentoring have been received by ADEQ. ADEQ will then convene a meeting of all systems willing to provide mentoring services during which where applications for mentoring services will be reviewed and pairing of mentors to systems requesting assistance will be made. An emphasis will be placed on allowing mentors to choose the systems they wish to assist.

Types of Assistance

There are various ways mentors can assist small water systems to comply with the new arsenic standard. Below are some mentoring examples:

1. Understanding the AMP: Mentors can assist small water systems by helping them understand the goals of the AMP and assisting them with understanding the options and resources that are available to them.
2. Compliance Plan: Mentors can assist small water systems by helping them develop a compliance plan with specific milestones as they move forward towards compliance.
3. Economies of Scale: Prices of products and services are generally more competitive when larger volumes are purchased or acquired. Mentors can assist small water systems in purchasing equipment through an economies-of-scale approach.
4. Mentoring: Mentors that select a treatment option(s) for their large water systems can help a small water system(s) that also needs a treatment technology to comply with the new arsenic standard by making them part of the their contract(s) for installing, maintaining and operating the treatment technology, so that the small water system(s) can have the opportunity to take advantage of the economies of scale and pay a lesser price(s).

Mentoring Benefits

It is the goal of ADEQ to have all water systems comply with the new arsenic standard. Therefore, ADEQ, WIFA and ACC encourage large water systems to mentor those that need

help complying with the new arsenic standard. Below are some examples of benefits that mentors will receive:

1. Environmental Excellence Award: The department plans to develop an award for systems that will be signed by ADEQ's director. Mentors may include mention of this award in their annual CCR.
2. Reduced WIFA Interest Rate: Qualification for lower interest rates when borrowing State Revolving Funds (SRF) from WIFA.

Professional Development Hours

The new operator certification regulations require water system operators to gain 30 professional development hours (PDHs) every three years to maintain their operator certification. ADEQ will allow mentors to gain PDHs for mentoring activities.

Mentor Qualifications

For a water system to qualify as a mentor, it will need to meet the following requirements must be met:

1. Compliance History: It is essential that mentors have a good compliance history with ADEQ. A water system with a good compliance record proves that it is not only capable financially, technically and managerially but it is responsible as well. ADEQ's database has the capability to determine compliance status of water systems. Only water systems with a good compliance history will be permitted to mentor under the AMP.
2. Training: Mentors need to attend a one-day training session provided by ADEQ or a delegated organization. Upon completion of training, mentors will receive certification from ADEQ. The training material is discussed in detail in Chapter Four, Technical Assistance.

It is anticipated that mentors will be providing a wide variety of assistance to the systems they have chosen. Arrangements for mentoring services can range from more formal to less formal. Some mentoring assistance may be handled through simple telephonic discussion. Mentors may choose to work through a more formalized relationship that might consist of regular meetings and site visits to the mentored system. Regardless of the degree of formality and structure the mentoring water system wishes to employ, central to success of the mentoring program is the open exchange on information and advice is central to the success of the mentoring program.

Liability

Depending on the type of mentoring that is being provided, there may be liability issues may need to be addressed. ADEQ is developing a generic liability release for mentoring water systems to use as a model to address such concerns. Mentors may wish to use this release as written, or may chose to consult their legal departments to make appropriate modifications for their particular circumstance. It is important for the water systems being mentored to understand that it is ultimately their responsibility to comply with the drinking water regulations. In order to facilitate

mentoring activities it is suggested that a water system seeking mentoring assistance sign a liability agreement relieving the mentor of any liability. ADEQ hopes that liability concerns will be overcome through cooperation and understanding between mentors and the systems so that they are providing assistance in a way to allow meaningful information exchange leading to benefits to the water systems and the citizens of Arizona.

Mentoring Incentives
ADEQ incentives for systems providing mentoring services include:

1. Awarding of professional development hours (PDHs) to operators for use toward operator certification renewal.
2. Recognizing mentors annually through the ADEQ "*Safe Drinking Water Helping Hand Award*."

Technical Assistance

Small water systems concerned about compliance with the new federal arsenic standard face a number of challenges. Understanding the different interpretation of the new standard, treatment technologies and their applications, the financial impacts, and the increased complexity of the regulatory requirements are only some of the issues that must be addressed in order to meet the new standard. Many small water systems do not have the resources to adequately determine the full impact the new arsenic standard will have on their operation, or to explore all available options when designing a new compliance strategy.

This section of the AMP is designed to help individual water systems determine what type of assistance their system may need and to provide a list of persons and organizations who responded to the ADEQ technical assistance provider survey. By following a simple step-by-step process, water system owners and operators should be able to identify their needs and find the appropriate contractors and vendors to help in meeting those needs.

For Systems Listed in the Compliance Options Section of the AMP
In the Compliance Options section of the AMP, a list has been compiled of water systems that may have trouble meeting the new arsenic standard. These determinations are based on historic arsenic levels reported to ADEQ and information supplied by the systems themselves. ADEQ has also compiled water quality profiles for each of these systems. These profiles include data on raw water quality, geology around well locations and proximity of wells to one another.

Based on this information, the department has developed a set of recommendations for each of these systems. These recommendations may include non-treatment options, such as blending, if they are feasible, or treatment options. The recommendations are intended to give water systems the most cost effective compliance options for each system based on water quality, population served and geographic location.

We encourage systems to review these recommendations carefully. If technical assistance is

needed, refer to the appropriate category below and then to Appendix A for a corresponding list of technical assistance providers. The Appendix A listings are not comprehensive but do represent those technical assistance providers who wished to be included in this document. You may want to consult your local yellow pages for additional providers.

Non-Treatment Options – Contractor or Vendor Technical Assistance is Available in the Following Categories:

- Water system planning, operation and management
- Regulatory issues
- Legal assistance

Treatment Options – Contractor or Vendor Assistance is Available in the Following Categories:

- Treatment facility operation
- Regulatory issues
- Point of Use (POU) devices
- Water system planning, operation and management

Financial Considerations –Might Want to Look for Contractor or Vendor Assistance Available in the Following Categories:

- Financial planning
- Grant applications

If a system or operator does not believe the recommendations in this document are appropriate for the system, or the system is not listed, but the system or operator still has concerns about meeting the new standard, the following steps should help in determining the best compliance option:

Getting Started – Arsenic Benchmarking

Systems first need to determine if the new arsenic standard will actually have an impact on their operation. An accredited testing laboratory should be able to run the necessary tests to obtain an average value for arsenic in a system's finished water. Samples should be taken during times of normal operating conditions at each POE to ensure the results will accurately reflect whether the system is in compliance with the arsenic standard, or if the system will need treatment to comply with the arsenic standard. Systems should already have a working relationship with at least one accredited laboratory, but a list of these facilities can be obtained from the Arizona Department of Health Services by calling (602) 364-0720.

Non-Treatment Options

If a system determines that they will not be able to meet the new arsenic standard, they must decide what course of action to take to meet the new requirements. Non-treatment options are a

good first step to consider. These options do not involve actively altering the chemistry of the water before it is sent to customers. They include:

- Blending
- Consolidating water sources
- Modifying source water contributions to a well by altering the well design
- Replacing water sources
- Merging with other water systems
- Becoming consecutive to another water system

Non-treatment options may require less up-front cost and less maintenance than treatment options. However, some non-treatment options may require significant changes to the overall configuration and operation of the water system. Some require specialized knowledge of applicable statues and rules to ensure the final system configuration or mode of operation will be in compliance.

Non-Treatment Options – Contractor or Vendor Technical Assistance is Available for the Following Categories:

- Water system planning, operation and management
- Regulatory issues
- Legal assistance

Treatment Options

If a system cannot comply with the new arsenic standard and non-treatment options are not appropriate, treatment options will need to be explored. They include:

- Reverse osmosis
- Activated alumina
- Ion exchange
- Lime softening
- Point of Use (POU) devices

Water systems should carefully consider the merits of different treatment options since treatment is typically more expensive to implement and maintain than non-treatment options. Treatment options also may require extensive improvements to existing facilities. Factors such as raw water quality, population served, infrastructure design, operator proficiency and available resources must all be taken into account before deciding on a final treatment type.

Treatment Options – Contractor or Vendor Technical Assistance is Available for the Following Categories:

- Treatment facility operation

- Regulatory issues
- Point of Use (POU) devices
- Water system planning, operation and management

When considering treatment options, it is important for water systems to look at treatment technologies with proven track records. When choosing newly developed treatment technologies you should review specifications and performance data to ensure the technology will work for your system. Additionally, EPA establishes a list of Best Available Technologies (BATs) for each regulation it establishes. BATs are technologies that EPA has found to be proven through full scale field conditions. A listing of EPA-approved BATs can be found beginning on Page 18 of the *Small System Compliance Technology List for the Non-Microbial Contaminants Regulated Before 1996* document, which is located at www.epa.gov/OGWDW/standard/tlstnm.pdf.

Financial Considerations

Both non-treatment or treatment options are likely to significantly impact the finances of small water systems. Systems may need to seek advice on these matters even if no major changes to their operations are made. They include:

- Rates and rate structures
- Rate comparisons by area
- Budgeting
- Emergency funds
- Loans and lines of credit
- Funding for capital improvements

Financial Considerations – Contractor or Vendor Technical Assistance is Available for the Following Categories:

- Financial planning
- Grant applications

In addition, the Arizona Corporation Commission and the Water Infrastructure Finance Authority may be able to assist small water systems with financial information.

List of Contractors and Vendors

The contractors and vendors in the list that begins on Page 40 responded to a questionnaire mailed out by ADEQ. These vendors were approached by ADEQ because they were on a list of pre-approved service providers assembled by the state procurement office. The different areas of contractor and vendor expertise were determined based on the questionnaire.

As with any contracting, due diligence is advised before hiring a contractor. Request information on past projects, staff qualifications and experience. A water system should ensure that the contractor or vendor they are interested in retaining fully understands and can completely

perform the work before the project begins.

Questions concerning the arsenic regulation or the Arsenic Master Plan can be directed to ADEQ toll free at (800) 234-5677 or at (602) 771-4644.

Contractors and Vendors					
Firm Name and Address	**Phone Number**	**Fax Number**	**Web Site** **E-mail**	**Contact Name(s)**	**Technical Assistance Offered**
AlpEx 3113 E. Table Mountain Rd. Tucson, AZ 85718-1323	(520) 577-9494	(520) 577-9479	www.alpex.com hat@alpex.com	Henry Truebe	Water System Planning Arsenic Source Identification and Mapping
Applied EnviroSolutions, Inc. 1445 E. Gaudalupe Rd. Suite 201 Tempe, AZ 85283	(480) 839-7000 (800) 478-7611	(480) 820-5030	www.aesaz.com aesaz@dancris.com	Chad Johnson	Treatment Options Non-Treatment Options Point of Use (POU) Water System Planning Water System Operation Treatment Facility Operation Regulatory Expertise Grant Application Legal Permitting Sampling and Reporting
Aquatic Consulting & Testing, Inc. 1525 W. University Drive Suite 106 Tempe, AZ 85281	(480) 921-8044	(480) 921-0049	www.aquaticconsulting.com actlab@sprintmail.com cchristian@aquaticconsulting.com	Rob Root	Treatment Options Non-Treatment Options Point of Use (POU) Water System Operation
Ballinger Consultants, P.C. P.O. Box 12187 Scottsdale, AZ 85267	(602) 266-7031	(480) 419-0606	N/A cbattinger@bcpc.net	Charles Ballinger, P.E.	Treatment Options Non-Treatment Options Point of Use (POU) Water System Planning Water System Operation Treatment Facility Operation Regulatory Expertise Water System Management Grant Application

Firm Name and Address	Phone Number	Fax Number	Web Site E-mail	Contact Name(s)	Technical Assistance Offered
BEM Systems, Inc. 77 E. Weldon Ave. Suite 210 Phoenix, AZ 85012	(602) 266-2011	(602) 274-3474	www.bemsys.com jmieher@bemsys.com	John Mieher	Treatment Options Non-Treatment Options Point of Use (POU) Water System Planning Water System Operation Treatment Facility Operation Regulatory Expertise Water System Management
Black & Veatch 2850 E. Camelback Rd. Suite 240 Phoenix, AZ 85016	(602) 381-4400	(602) 381-4440	www.bv.com mollsj@bv.com	Sara Moll	Treatment Options Non-Treatment Options Point of Use (POU) Water System Planning Financial Planning Regulatory Expertise Water System Management Grant Application
Brown & Caldwell Engineers 201 E. Washington St. Suite 500 Phoenix, AZ 85004	(602) 567-3878	(602) 567-4001	www.brownandcaldwell.com kraman@brwncald.com	Kalyan Raman	Treatment Options Non-Treatment Options Water System Planning Financial Planning Water System Operation Treatment Facility Operation Regulatory Expertise Water System Management Grant Application
Bucher, Willis & Ratliff Corp. 18001 N. 79th Ave. Suite B-36 Glendale, AZ 85308	(623) 776-9184	(623) 487-7902	www.bwrcorp.com akolcz@bwrcorp.com	Andrew Kolcz	Treatment Options Water System Planning

Firm Name and Address	Phone Number	Fax Number	Web Site E-mail	Contact Name(s)	Technical Assistance Offered
Coe & Van Loo Consultants, Inc. 4550 N. 12th St. Phoenix, AZ 85014-4291	(602) 264-6831	(602) 264-0928	www.cvlci.com elaurin@cvlci.com	Eric Laurin	Treatment Options Non-Treatment Options Point of Use (POU) Water System Planning Financial Planning Water System Operation Treatment Facility Operation Regulatory Expertise Water System Management Grant Application
Damon S. Williams Associates, L.L.C. 3838 N. Central Ave. Suite 1700 Phoenix, AZ 85012-1906	(602) 265-5400	(602) 265-5632	www.dswa.net mdehaan@dswa.net	Michelle De Haan	Treatment Options Non-Treatment Options Point of Use (POU) Water System Planning Financial Planning Water System Operation Treatment Facility Operation Regulatory Expertise Water System Management Grant Application Legal
Daniel B. Stephens & Associates, Inc. 6020 Academy Rd. NE Suite 100 Albuquerque, NM 87109	(505) 822-9400	(505) 822-8877	www.dbstephens.com N/A	N/A	Treatment Options Non-Treatment Options Point of Use (POU) Water System Planning Financial Planning Water System Operation Treatment Facility Operation Regulatory Expertise Water System Management Grant Application Legal Emerging Arsenic Technologies

Firm Name and Address	Phone Number	Fax Number	Web Site E-mail	Contact Name(s)	Technical Assistance Offered
David Evans & Associates, Inc. 7878 N. 16th St. Suite 250 Phoenix, AZ 85020	(602) 678-5151	(602) 678-5155	www.deainc.com gjb@deainc.com	Greg Barry, M.S., P.E.	Treatment Options Non-Treatment Options Point of Use (POU) Water System Planning Financial Planning Water System Operation Treatment Facility Operation Regulatory Expertise Water System Management Grant Application
Desert Land Engineering, Inc. 8107 E. Cambridge Ave. Scottsdale, AZ 85257	(480) 429-1750	(480) 429-1751	www.desertlandengineering.com desertland@aol.com	Rick Gutierrez	Water System Planning
Eberline Services, Inc. 7021 Pan American Freeway NE Albuquerque, NM 87109	(505) 262-2694	(505) 262-2698	www.eberlineservices.com vybarra@eberlineservices.com	Veronica Ybarra	Treatment Options Non-Treatment Options Water System Operation Treatment Facility Operation Regulatory Expertise
Ecosphere Environmental Services 2257 Main Ave. Durango, CO 81301	(970) 382-7256	(970) 382-7259	www.ecosphere-services.com jankowski@ecosphere-services.com	Paul Jankowski	Treatment Options Non-Treatment Options Point of Use (POU) Regulatory Expertise Water System Management
Enecotech Southwest, Inc. 449 S. 48th St. Suite 101 Tempe, AZ 85281	(480) 894-2440	(480) 894-2466	www.enecotech.com billgill@enecotech.com	Bill Gill	Treatment Options Non-Treatment Options Point of Use (POU) Water System Planning Regulatory Expertise Geological

Firm Name and Address	Phone Number	Fax Number	Web Site E-mail	Contact Name(s)	Technical Assistance Offered
Entranco 7740 N. 16th St. Suite 200 Phoenix, AZ 85020-4462	(602) 889-7000	(602) 889-7101	www.entranco.com dmanthe@entranco.com	Dan Manthe, P.E.	Treatment Options Non-Treatment Options Point of Use (POU) Water System Planning Financial Planning Water System Operation Treatment Facility Operation Regulatory Expertise Water System Management Grant Application
Environmental Health Laboratories 110 S. Hill St. South Bend IN 46617	(574) 233-4777 (800) 332-4345	(574) 233-8207	www.ehl.cc rfb@ehl.ul.com	Paul Bowers	Regulatory Expertise Testing
Environmental Resources Management 7975 N. Hayden Rd. Suite D-354 Scottsdale, AZ 85258	(480) 998-2401	(480) 998-2106	www.erm.com david.abranovic@erm.com	David Abranovic, P.E.	Treatment Options Non-Treatment Options Point of Use (POU) Water System Planning Financial Planning Water System Operation Treatment Facility Operation Regulatory Expertise Water System Management Legal
Errol L. Montgomery & Associates, Inc. 7949 E. Acoma Dr. Suite 100 Scottsdale, AZ 85260	(480) 948-7747	(480) 948-8737	www.elmontgomery.com N/A	Dennis Shirley, P.G.	Treatment Options Non-Treatment Options Point of Use (POU) Water System Planning Water System Operation Water System Management Grant Application

Firm Name and Address	Phone Number	Fax Number	Web Site E-mail	Contact Name(s)	Technical Assistance Offered
FaciliGroup Corporation 1745 S. Alma School Rd. Suite 210 Mesa, AZ 85210	(480) 491-4208	(480) 491-2363	www.faciligroup.net allanc@faciligroup.net	Allan Converse	Treatment Options Non-Treatment Options Point of Use (POU) Water System Planning Financial Planning Water System Operation Treatment Facility Operation Regulatory Expertise Water System Management Grant Application Legal
Fluid Solutions 1121 E. Missouri Ave. Suite 100 Phoenix, AZ 85014	(602) 274-6725	(602) 274-6773	www.flusol.com khendricks@flusol.com nfain@flusol.com	Kathy Hendricks, P.E. Norm Fain, P.E.	Treatment Options Non-Treatment Options Point of Use (POU) Water System Planning Financial Planning Water System Operation Treatment Facility Operation Regulatory Expertise Water System Management Grant Application
Gannett Fleming, Inc. 3001 E. Camelback Rd. Suite 130 Phoenix, AZ 85016	(602) 553-8817	(602) 553-8816	www.gfnet.com aobrien@gfnet.com	Alan O'Brien	Treatment Options Non-Treatment Options Point of Use (POU) Water System Planning Financial Planning Water System Operation Treatment Facility Operation Regulatory Expertise Water System Management Grant Application Legal

Firm Name and Address	Phone Number	Fax Number	Web Site E-mail	Contact Name(s)	Technical Assistance Offered
Geotechnical and Environmental Consultants, Inc. 1900 W. Broadway Rd. Tempe, AZ 85282-1000	(480) 966-8631	(480) 966-8821	www.gecaz.com cpearson@gecaz.com	Chet Pearson	Treatment Options Non-Treatment Options Water System Planning Water System Operation Treatment Facility Operation Regulatory Expertise Water System Management
Gram, Inc. 8500 Menaul Blvd. NE Suite B-335 Albuquerque, NM 87112	(505) 299-1282 (505) 998-5180	(505) 296-3289	www.graminc.com dmball@graminc.com	David Ball	Treatment Options Non-Treatment Options Water System Planning Regulatory Expertise Water System Management
Hanson Professional Services, Inc. 1525 S. Sixth St. Springfield, IL 62703	(217) 788-2450	(217) 788-2503	www.hanson-inc.com kseals@hanson-inc.com	Kevin Seals	Water System Planning Water System Operation Treatment Facility Operation Regulatory Expertise Water System Management
HDR Engineering, Inc. 2141 E. Highland Ave. Suite 250 Phoenix, AZ 85016	(602) 508-6600	(602) 508-6606	www.hdrinc.com tgalezie@hdrinc.com	Tom Galeziewski, P.E.	Treatment Options Non-Treatment Options Water System Planning Water System Operation Treatment Facility Operation Regulatory Expertise Water System Management Grant Application

Firm Name and Address	Phone Number	Fax Number	Web Site E-mail	Contact Name(s)	Technical Assistance Offered
HydroGeoLogic, Inc. 340 E. Palm Lane Suite A240 Phoenix, AZ 85004	(602) 307-0047	(602) 307-0048	www.hgl.com jrobertson@hgl.com	John Robertson, P.G.	Treatment Options Non-Treatment Options Point of Use (POU) Water System Planning Treatment Facility Operation Regulatory Expertise Water System Management Legal
Hyperion International Technologies, LLC 5016 S. Ash Ave. Suite 101 Tempe, AZ 85282	(480) 897-6800	(480) 820-8691	www.hyperionintl.com hyperion_1@msn.com	Maurice Chait, P.E.	Treatment Options Point of Use (POU) Water System Planning Financial Planning Water System Operation Treatment Facility Operation Regulatory Expertise
Integrated Arsenic Systems, Inc. Box 44496 Phoenix, AZ 85064	(480) 488-6589	(480) 488-2525	www.arsenicsystems.com john@arsenicsystems.com	John Spielman	Treatment Options Non-Treatment Options Point of Use (POU) Water System Planning Financial Planning Water System Operation Treatment Facility Operation Regulatory Expertise Water System Management Grant Application
Kleinfelder 1951 W. Camelback Rd. Suite 460 Phoenix, AZ 85015	(602) 841-8880	(602) 841-8881	www.kleinfelder.com mhulst@kleinfelder.com	Mike Hulst	Treatment Options Non-Treatment Options Point of Use (POU) Water System Planning Regulatory Expertise Grant Application

Firm Name and Address	Phone Number	Fax Number	Web Site E-mail	Contact Name(s)	Technical Assistance Offered
LFR Levine • Fricke 13880 N. Northsight Blvd. Suite 115 Scottsdale, AZ 85620	(480) 905-9311	(480) 905-9353	www.lfr.com ned.overs@lfr.com	Ned Overs, P.E.	Treatment Options Non-Treatment Options Point of Use (POU) Water System Planning Water System Operation Treatment Facility Operation Regulatory Expertise Water System Management
M3 Engineering & Technology Corporation 2440 W. Ruthrauff Rd. Suite 170 Tucson, AZ 85705 6501 W. Frye Rd. Suite 21 Chandler, AZ 85226	(520) 293-1488 (480) 753-3607	(520) 293-8349 (480) 753-3617	www.m3eng.com m3@m3eng.com (Tucson) m3phx@m3eng.com (Chandler)	William Curtis (Chandler office)	Treatment Options Non-Treatment Options Point of Use (POU) Water System Planning Financial Planning Water System Operation Treatment Facility Operation Regulatory Expertise Water System Management Grant Application
Malcolm Pirnie, Inc. 4646 E. Van Buren St. Suite 400 Phoenix, AZ 85008-6945	(602) 241-1770	(602) 231-0131	www.pirnie.com skommineni@pirnie.com	Zaid Chowdhury	Treatment Options Non-Treatment Options Point of Use (POU) Water System Planning Financial Planning Water System Operation Treatment Facility Operation Regulatory Expertise Water System Management Grant Application Legal

Firm Name and Address	Phone Number	Fax Number	Web Site E-mail	Contact Name(s)	Technical Assistance Offered
Miller Brooks Environmental, Inc. 202 W. Earll Drive Suite 470 Phoenix, AZ 85012	(602) 728-0577	(602) 728-0585	www.millerbrooksenv.com johnreissjr@millerbrooksenv.com	John Reiss, Jr.	Treatment Options Non-Treatment Options Point of Use (POU) Water System Planning Water System Operation Treatment Facility Operation Regulatory Expertise Water System Management
Narasimhan Consulting Services, Inc. 3150 N. 24th St. Suite D-104 Phoenix, AZ 85016	(602) 629-0206	(602) 629-0223	www.ncseng.com ram@ncseng.com	Ramesh Narasimhan	Treatment Options Non-Treatment Options Point of Use (POU) Water System Planning Financial Planning Water System Operation Treatment Facility Operation Regulatory Expertise Water System Management Grant Application Legal
Notaro Group Water Chef Inc.	(480) 473-9882	(480) 473-9882	joenotaro@msn.com	Joseph P. Notaro	Treatment Option Point of Use (POU) Point of Entry (POE) Water System Operation Treatment Facility Operation
Pollution Prevention International 25 Mauchly Suite 316 Irvine, CA 92618	(949) 757-2690	(949) 757-2715	www.ppint.com sales@ppint.com	Christian Tasser	Treatment Options Point of Use (POU) Regulatory Expertise Grant Application
ProChemTech International, Inc. 2475 W. Dallas Ave. Apache Junction, AZ 85220	(480) 983-5385	(480) 983-5408	www.prochemtech.com prochemtech@qwest.net	N/A	Treatment Options Treatment Facility Operation

Firm Name and Address	Phone Number	Fax Number	Web Site E-mail	Contact Name(s)	Technical Assistance Offered
RBF Consulting 16605 N. 28th Ave. Suite 100 Phoenix, AZ 85053-7550	(602) 467-2200	(602) 467-2201	www.rbf.com bsquire@rbf.com	Brandon Squire, P.E.	Treatment Options Non-Treatment Options Water System Planning Water System Operation Regulatory Expertise Water System Management
Shephard-Wesnitzer, Inc. 115 E. Goodwin St. Suite G Prescott, AZ 86303	(928) 541-0443	(928) 541-1075	www.swiaz.com sherman@swiaz.com	Stephen Herman, P.E.	Treatment Options Non-Treatment Options Point of Use (POU) Water System Planning Financial Planning Water System Operation Treatment Facility Operation Regulatory Expertise Water System Management Grant Application
Southwest Civic Professionals, Inc. 2303 N. 44th St. Suite 14-1121 Phoenix, AZ 85008-2442	(602) 438-8511 (602) 315-3617	(413) 647-6204	N/A southwestcp@sprintmail.com	N/A	Treatment Options Non-Treatment Options Point of Use (POU) Water System Planning Financial Planning Water System Operation Treatment Facility Operation Regulatory Expertise Water System Management Grant Application Legal Mediation Public Education

Firm Name and Address	Phone Number	Fax Number	Web Site E-mail	Contact Name(s)	Technical Assistance Offered
Tetra Tech/HSI GeoTrans 4801 E. Washington St. Suite 260 Phoenix, AZ 85034	(602) 682-3300	(602) 244-1164	www.tetratech.com fred.renn@tetratechgroup2.com	Fred Renn	Treatment Options Non-Treatment Options Point of Use (POU) Water System Planning Financial Planning Water System Operation Treatment Facility Operation Regulatory Expertise Water System Management Grant Application Legal
Tierra Dynamic Co. P.O. Box 35188 Phoenix, AZ 85069	(602) 864-3887	(602) 864-3990	www.tierradynamic.com dankelly@tierradynamic.com	J. Dan Kelly	Treatment Options Non-Treatment Options Point of Use (POU) Water System Planning Water System Operation Treatment Facility Operation Regulatory Expertise Water System Management Grant Application
TNT Technology Company 2121 W. University Dr. Suite 119-2B Tempe, AZ 85281-9469	(480) 966-9891	(480) 968-9469	www.tnttechnologycompany.com vicky@tnttechnologycompany.com	Victoria Allies	Treatment Options Non-Treatment Options Point of Use (POU) Water System Planning
Tramfloc, Inc. P.O. Box 350 Tempe, AZ 85280-0350	(480) 491-6895	(480) 456-1664	www.tramfloc.com water@tramfloc.com	Richard Binkowski	Treatment Options
Trueline Engineering 609 S. Fifth Ave. Safford, AZ 85546	(928) 428-1504	(928) 428-1878	N/A	Greg Lorang, P.E.	Treatment Options Non-Treatment Options Water System Planning Regulatory Expertise Grant Application

Firm Name and Address	Phone Number	Fax Number	Web Site E-mail	Contact Name(s)	Technical Assistance Offered
			gregl@truelineengineering.com		
Watermasters, Inc. Box 47146 Phoenix, AZ 85068-7146	(800) 678-0211	(602) 678-0388	www.watermasters.com info@watermasters.com	N/A	Treatment Options Non-Treatment Options Water System Operation Treatment Facility Operation
Water Tec of Tucson, Inc. 350 E. Irvington Rd. Tucson, AZ 85714-2822	(520) 790-1512 (800) 343-1512	(520) 790-1514	www.water-tec.com watertec@water-tec.com	Jennifer DeGrave	Treatment Options Non-Treatment Options Point of Use (POU) Water System Planning Water System Operation Treatment Facility Operation
Water Treatment Technologies, Inc. 2445 E. University Dr. Phoenix, AZ 85034	(602) 275-8280	(602) 275-6722	N/A wttinc@att.net	Robin Pettyjohn	Treatment Options Point of Use (POU) Water System Planning Water System Operation Treatment Facility Operation Water System Management
Paul Westerhoff, Ph.D, P.E. Arizona State University Box 5306 Tempe, AZ 85287	(480) 965-2885	(480) 965-0557	N/A N/A		Treatment Options Point of Use (POU)
Western Environmental Technologies P.O. Box 4752 Cave Creek, AZ 85327	(480) 488-1385	(480) 488-9623	N/A wetrhanus@aol.com	Robert Hanus	Water System Operation Water System Management

Firm Name and Address	Phone Number	Fax Number	Web Site E-mail	Contact Name(s)	Technical Assistance Offered
Wilson & Company 9633 S. 48th St. Suite 290 Phoenix, AZ 85044	(480) 893-8860	(480) 893-8968	www.wilsonaz.com jcdowell@phx.wilsonco.com	James Dowell, P.E., D.E.E.	Treatment Options Non-Treatment Options Point of Use (POU) Water System Planning Water System Operation Treatment Facility Operation Regulatory Expertise Water System Management Grant Application